Abstract: The minimum capacity levels for minor league baseball stadiums recommended by Major League Baseball present a unique opportunity to examine optimal stadium size for sports teams. Using a data set of game-by-game data for 30 teams at the AAA level over a five year period from 2006 to 2010 and yearly attendance from 1992 to 2010, we find that five baseball stadiums at the AAA level may be too large. This raises the question of whether or not the MLB-recommended minimum stadium capacity is suboptimal for all levels of minor league baseball. The analysis presented in this paper can be useful to minor league baseball executives and planners considering building or renovating stadiums in cities with these baseball teams.
Introduction

The Dayton Dragons, a minor league baseball team, made national headlines in 2011 by setting the professional sports record for most consecutive sellouts. While the current streak of selling out over 900 consecutive home games suggests that fans in Dayton are probably very loyal, it also suggests their stadium may be too small. Some potential paying fans may be unable to attend what Sports Illustrated has called one of the hottest tickets in sports, so Dragons’ ownership may be leaving revenue on the table because there are too few seats for these potential paying fans. But the Dayton Dragons story is not even close to the norm in minor league baseball. Sellouts are rare for a majority of the nearly 200 minor league baseball teams across the United States. Consequently, stadiums where a majority of minor league baseball teams play may be too large and too costly to build and maintain because they are not reaching capacity often enough.

While income, population, and past success are just a few of the factors expected to contribute to the decision of how large a minor league baseball stadium to build, one factor stands out above all others. Major League Baseball (MLB) recommends that affiliated minor league teams construct stadiums with a minimum capacity of 4,000 for A, 6,000 for AA and 10,000 for AAA. Included as Attachment 58 in the Major League Rules, this recommendation is perhaps too high for the teams that don’t regularly come close to selling out games. While most teams adhere to these recommendations, many teams have built stadiums at or near the recommended level and only a few have built stadiums below that level. It is possible that these recommendations in the Major League Rules lead teams to build stadiums that are too large given their demand and the costs associated with additional seating. The goal of this paper is therefore to test these league recommendations to see if they are optimal. We link minor league baseball to a literature that suggests that having binding constraints could make the product appear more enticing and therefore increase demand further.

Our results show that five of the teams in AAA minor league baseball would potentially benefit from playing in a stadium with fewer than 10,000 seats. That is, the recommended capacity is too high for a non-negligible number of the teams in AAA baseball. We infer from this result that a long-run plan of changing MLB recommended capacities for minor league baseball stadiums could have positive benefits for some teams considering building new or renovated stadiums in the coming years. The remainder of the paper is arranged as follows. The next section briefly reviews the associated literature. Section three presents a theoretical model, section four describes the data and section five presents the results. The last section concludes.

Literature Review

There are nearly 200 affiliated minor league baseball teams across the United States, with over half of these teams playing in a stadium built during a boom in stadium construction in the last 20 years (Gitter and Rhoads, 2010). Each MLB team has one affiliated minor league team at the AAA (highest) and AA (second highest), and typically another 2-3 teams at the A level and another team at the Rookie level. In this paper, we examine the question of what is the optimal stadium size for minor league baseball teams
at the AAA level and begin to probe the effect that MLB-recommended stadium size has on minor league baseball revenue generating capabilities.

Revenue for a minor league baseball team comes from a variety of sources. As one major component of revenue, ticket sales can be impacted by factors ranging from the likelihood of the home team winning (see Gitter and Rhoads 2010) and quality of opponent to promotions such as fireworks and bobbleheads (Gifis and Sommers 2006; Cebula 2009; and Cebula, Toma and Carmichael 2009). Regardless of how effective any given factor is in increasing ticket sales, stadium capacity represents an upper limit to the number of tickets that can be sold to an event. Larger stadium capacities allow for higher ticket sales, but not without the additional cost that comes from building and maintaining a larger facility. Smaller stadiums that are less expensive to build and maintain come with the costs of turning away potential paying fans. Minor league baseball teams often do not sell out games. For a majority of teams, sellouts are quite rare. In our sample of AAA games from 2006 to 2010, nearly 20% of teams did not sell out a game in a given year, while only half sold out more than three games. This suggests that league recommendations may not be optimal for maximizing revenue and profits.

The cost of these stadiums represents millions of dollars and substantial proportions of municipal spending in smaller cities. Gitter and Rhoads (forthcoming) have shown that new minor league baseball stadiums led to substantial increases in attendance in the stadiums’ first year (25-40% depending on the level) and continued to provide boosts as much as 5% up to ten years after construction. This honeymoon effect is similarly found in MLB, the National Basketball Association (NBA) and the National Hockey League (NHL) (see Coates and Humphreys 2005 and Clapp and Hakes 2005). Despite these increases in attendance and all the affiliated revenues, our calculations suggest without substantial spillovers these new stadiums were unlikely to cover their construction cost.

Becker’s (1991) suggestion that social influences can impact demand helps explain situations like the Dayton Dragons. Selling tickets to a minor league baseball game becomes easier when those games are typically sold out. But the opposite may also be true—selling tickets to a minor league baseball game becomes more difficult when those games typically have many unsold seats.1 Because people consume minor league baseball games together and in public, there is a strong social influence on demand for tickets stemming from attending a game that is either sold out or close to sold out. Therefore, the number of seats in the stadium can impact the likelihood of a sellout. Too many empty seats are not good, while not enough seats may be optimal. We are careful to note that while pricing decisions are critical for maximizing revenue for stadiums with fixed capacity, decision makers seeking to maximize revenue first must treat stadium capacity as a variable before it is even built (see Williamson 1966). Treating stadium capacity as a variable allows us to build a theoretical framework beginning in the next section.

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1 At the major league level, the Oakland A’s and the Miami Marlins have substantially reduced their stadium capacity in recent years. Although the A’s play in a ballpark also used for football, it does imply that stadiums can be too large.
Theoretical Model

Using a theoretical framework developed by El Hodiri and Quirk (1974), we create a set of hypotheses that we test using a data set of 10,343 minor league games at the AAA level between 2006 and 2010. The data set is used to provide a descriptive analysis of the frequency of sell outs at minor league games. We suggest that in cases where sellouts never or rarely occur, teams could possibly increase profit by reducing stadium capacity, but this would require a change of minimum stadium capacity size in many cases. We use our data to estimate the reduction in total revenue based on reduced capacity and compare it to estimates of the marginal cost of additional capacity. To calculate lost revenue for a potential capacity size we examine each game’s attendance. In cases where attendance exceeds the hypothetical capacity we estimate lost revenue as a function of the lowest ticket prices. We use the lowest ticket prices because marginal seats for the potential capacity constraints are likely to be those furthest away from home plate. We then sum the estimated lost revenue for each team and year.

El Hodiri and Quirk (1974) develop a model for ticket demand for individual \( y_i(p, X, t) \) based on price \( p \), capacity \( X \) and age of the stadium \( t \) and only briefly note the relationship between capacity and demand for tickets. In most cases, they suggest that as capacity grows the demand for tickets declines since additional seats are likely to be further away from the field. Becker (1991) suggests that restaurants regularly experiencing excess demand could be creating additional utility for consumers who enjoy a popular good, and thus increase demand even further.

We extend the two models referenced above by including the percentage of capacity in a model of minor league baseball ticket demand. We assume the demand for tickets is based in part on the ratio of the expected value of all tickets sold, \( EY \), divided by capacity.

\[ 1) \quad y_i(p, X, t, \frac{EY}{X}) \quad \text{or} \quad Y(p, X, T) \]

The team then pays the total cost per year of the stadium \( C(y, X, t) \) based on the number of tickets sold, capacity, the stadium’s age and a fixed construction cost \( I \) based on the stadium capacity. The owner’s long run optimization problem is to maximize the profit of the team over the lifetime of the stadium \( T \) based on an interest rate \( i \). However, teams are somewhat constrained in their choice of capacity as Major League Baseball recommends that minor league baseball teams have a minimum level of capacity. Specifically, stadiums for AAA teams in minor league baseball are recommended to have a seating capacity of at least 10,000. To represent this rule, we add the constraint that \( X \) must be greater than \( X' \) (the league mandated minimum).

\[ 2) \quad \max_\theta = \sum_{t=1}^T pY(p, X, t) - C(Y, X, t) \frac{1}{1+i^t} - I(X), \quad \text{such that} \quad X > X'. \]

Solving the Lagrangian yields the result noted by El Hodiri and Quirk. Increased capacity is assumed to reduce demand, so the owner adds capacity to maximize profit until the increase in capital cost \( I \) is

\[ ^2 \text{We have made slight changes to El Hodiri and Quirk’s notation for readability} \]

\[ ^3 \text{In some cases they suggest adding seats might add breathing room, but they suggest this case is rare.} \]
equal to the increase in the discounted profits of additional capacity. If the optimal capacity, $X$, is below the MLB-mandated minimum capacity, $X'$, the owner builds a stadium to satisfy the minimum stadium capacity. When this constraint is binding the league recommendations for stadium capacity reduce profit, because the marginal cost of an additional unit of capacity exceeds the marginal revenue. This inequality is represented in the equation below where the marginal revenue of additional capacity, $X$, is shown on the left hand side, while the marginal cost is on the right hand side and is the sum of the short run costs, $C$, and the fixed stadium construction cost, $I$.

$$
3) \sum_{t=1}^{T} \frac{p}{(1+i)^t} \frac{\partial Y(p,X,t)}{\partial X} < \sum_{t=1}^{T} \frac{1}{(1+i)^t} \frac{\partial C(Y_t,X,t)}{\partial X} + \frac{\partial I(X)}{\partial X}
$$

Data Description

The data set used for the analysis contains all of the 30 MLB-affiliated minor league teams at the AAA level, which is the highest level of minor league baseball. Attendance data on the over 10,000 games for these 30 teams extends from 2006 through 2010. Additionally we have collected data on stadium construction year and ticket prices using the annual Baseball America Directory (2006-2010). Later in the analysis we use yearly attendance averages provided by Baseball-Reference.org.

For the descriptive analysis, we have chosen to define a sellout as El Hodiri and Quirk (1974) do—ticket sales equaling 95% of stadium capacity. We show the number of games sold out for each team from 2006 to 2010 in Figure 1 below. Overall, teams reach a sellout—95% of stadium capacity—in only 9% of the games.

As noted, MLB recommends that AAA teams have a stadium with a minimum capacity of 10,000. In Figure 2 below, we present a histogram of stadium capacity for AAA level minor league baseball. Many teams build stadiums at or near the required capacity constraints, so the constraints appear to be binding or close to binding in many cases. As one example, we suggest that the MLB recommended stadium capacity was a major factor in the design of the Charlotte Knights Stadium in Fort Mill, SC, whose stadium capacity is 10,002.

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4 With the exception of one team—the 2006 Columbus Clippers—we have data on all AAA teams for all the years listed.
A stadium’s age also plays a role in the percentage of capacity used as seen in Table A below. Stadiums built in the last decade see substantially greater use of capacity than those built in the previous decade. These results are consistent with Gitter and Rhoads (2010), who show substantial increases in...
attendance in a stadium’s first decade. Note that there do not appear to be large differences in capacity across stadium construction years.

Table A: Stadium Construction Year, Capacity and Sellouts for AAA Baseball

<table>
<thead>
<tr>
<th>Year Range</th>
<th>% of Sellouts</th>
<th>Average Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre 1990 Stadiums</td>
<td>6%</td>
<td>13413</td>
</tr>
<tr>
<td>Stadiums built 1990-1999</td>
<td>6%</td>
<td>11794</td>
</tr>
<tr>
<td>Stadiums Built After 2000</td>
<td>15%</td>
<td>12188</td>
</tr>
</tbody>
</table>

The final variables used in the analysis are ticket prices, population and income. We use the lowest and highest ticket prices charged by each AAA team, and would have more data on discounts and the distribution of ticket prices across stadiums if it was easily available, but we have included the best available data on ticket prices available for minor league baseball. On average, ticket prices at AAA minor league baseball stadiums from 2006 to 2010 range from $6.26 at the low end to $12.66 at the high end.

**Empirical Analysis**

The empirical analysis estimates the potential lost revenue from a reduction in stadium size. To do this, we first need to determine a stadium’s capacity. All teams report a maximum capacity for their stadiums. But the maximum attendance was higher than the reported capacity for 80% of the teams and the average ratio between maximum attendance and reported capacity was 1.15, suggesting reported capacity may under report true capacity. We therefore use the larger of the maximum attendance or the reported capacity to calculate stadium size.

Next we need to calculate how much revenue a team would lose if they reduced their capacity to the league minimum of 10,000. We estimate this loss as the difference between observed attendance and the 10,000 minimum multiplied by the minimum ticket price. For example if a team had an attendance of 11,000 and their lowest ticket price was $5, we would estimate the team would lose $5,000 of ticket revenue for that game by reducing capacity to the 10,000 minimum. We can then sum the estimated losses for a season.

We have game by game attendance for 5 years of data (2006-2010). However we have yearly attendance for 19 years of data (1992-2010). To utilize this data we estimate the average yearly losses for teams during that 5 year period based on capacity, attendance and team fixed effects. We then use
the associated coefficients on capacity and attendance to estimate the potential lost revenue from league minimum stadium sizes for the 19 year period.

It is important to remember that revenue from selling tickets for seats is received every game, while capacity is a fixed cost that will be realized for decades. To highlight the relative relationship between revenue and cost we calculate the ratio of marginal revenue to marginal cost. For example if marginal revenue were 10% of stadium cost and there was no discounting, the cost of the seats would take ten years to pay back. Coates and Humpheries (2005) assume stadium bonds sold at 6-7% in their analysis of impacts of new MLB stadiums, so a 10% return on investment would suggest that the additional seats in the stadium have positive returns.

\[
\frac{\text{Marginal Revenue}}{\text{Marginal Cost}} = \frac{\sum_{\text{Game}=1}^{\text{Game}=n} \max \{0, (\text{attendance}_n - X) \times 2P_t \}}{200 \times \max \{0, \text{actual capacity} - X \}}
\]

Equation 4 above shows the ratio of the marginal revenue to marginal cost for seats in excess of the recommended capacity of 10,000. As described below we set the marginal cost for a seat at $200. For team \(i\), we calculate the revenue lost for each of \(n\) home games (typically about 70) using actual reported attendance for game \(n\). No revenue is lost if the recommended minimum capacity, \(X\), exceeds actual reported attendance. If attendance is greater than capacity \(X\), we estimate the lost revenue per fan as twice the team’s lowest ticket price \(p_t\). As noted above, the lowest ticket price is likely to reflect the value of the ticket at the margin. We multiply this lowest ticket price by two to account for lost concessions and parking based on an estimate that suggests tickets account for about half of revenues (Forbes 2008). The losses for each game are summed for the entire season of \(n\) games to get a total revenue lost for each team and year.

Next we estimate the marginal cost of an additional seat. A government document for construction of seating in Sugarland, TX suggests the cost of the seat itself is close to $100. Based on discussions with industry experts, this represents about half of the total cost because local laws typically mandate restrooms and parking based on seating capacity. That is, additional seats must be accompanied by more parking and concession. We therefore estimate the marginal cost of an additional seat as $200. The numerator of equation 4 above shows the difference between a team’s actual capacity and the league recommended minimum. In a few cases capacity is below league recommended minimums, which we discuss below.

Table B: Estimated Revenue Lost From 10,000 Seat Stadium

<table>
<thead>
<tr>
<th>City</th>
<th>Revenue Lost Per Year</th>
<th>MR/MC</th>
<th>Year Stadium Constructed</th>
<th>Seasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ottawa, ON</td>
<td>$</td>
<td>-</td>
<td>0%</td>
<td>1993</td>
</tr>
<tr>
<td>Reno, NV</td>
<td>$ 8,211</td>
<td>0%</td>
<td>2009</td>
<td>2</td>
</tr>
<tr>
<td>Tacoma, WA</td>
<td>$ 278</td>
<td>0%</td>
<td>1960</td>
<td>5</td>
</tr>
<tr>
<td>Colorado Springs, CO</td>
<td>$</td>
<td>-</td>
<td>1988</td>
<td>5</td>
</tr>
</tbody>
</table>
Table B above presents information on the ratio of marginal revenue to marginal cost. The first column is the estimated revenue over the course of a season for the listed team if they moved into a stadium that had a strict seating capacity of 10,000 seats. The second column is the ratio of marginal revenue to marginal cost. It is important to note that marginal revenue is based on the actual attendance in excess of 10,000 multiplied by the team’s lowest ticket price, while the marginal cost is estimated at $200 per seat with a capacity based on the highest reported attendance. Of the teams in AAA, 10 do not meet the 10% threshold—including Tacoma and Colorado Springs, who never reported more than 10,000 fans in one game. While both teams have capacities below 10,000, Tacoma did not sell out a game during the sample and Colorado Springs had only five games over the five year period that reached capacity.
The next to last column of the chart above shows the year the stadium was constructed. For the ten teams with marginal revenue to marginal cost ratios below 10%, the median year of stadium construction is 1992. Compare this to a median stadium construction year of 1997 for those teams with marginal revenue to marginal cost ratios greater than 10%. This likely reflects the honeymoon effect found by Gitter and Rhoads (2010) that shows attendance increased 40% in the first year of a stadium. Other than Columbus—where a new stadium was built in 2009—it is worth noting that for those teams with marginal revenue to marginal cost ratios above 10%, stadiums were at least five years old and available projections suggest that the investment of seats above 10,000 would have paid back.

Table C: Historical Attendance For Teams with MR/MC < 10% Ratios for 2006-2010**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Colorado Springs</td>
<td>0</td>
<td>1988</td>
<td>2685</td>
<td>3096</td>
<td>3059</td>
<td>3546</td>
<td>4228</td>
</tr>
<tr>
<td>Tacoma</td>
<td>0</td>
<td>1960</td>
<td>4426</td>
<td>4330</td>
<td>4689</td>
<td>4555</td>
<td>4895</td>
</tr>
<tr>
<td>Ottawa</td>
<td>0</td>
<td>1993</td>
<td>9351*</td>
<td>3808</td>
<td>3138</td>
<td>2444</td>
<td>X</td>
</tr>
<tr>
<td>Omaha</td>
<td>5</td>
<td>1948</td>
<td>5347</td>
<td>6247</td>
<td>5612</td>
<td>4258</td>
<td>5153</td>
</tr>
<tr>
<td>Nashville</td>
<td>8</td>
<td>1978</td>
<td>6136</td>
<td>3765</td>
<td>4518</td>
<td>5417</td>
<td>4242</td>
</tr>
<tr>
<td>New Orleans</td>
<td>8</td>
<td>1997</td>
<td>2248</td>
<td>7044*</td>
<td>7318</td>
<td>5275</td>
<td>5074</td>
</tr>
<tr>
<td>Syracuse</td>
<td>9</td>
<td>1997</td>
<td>3727</td>
<td>5645*</td>
<td>5922</td>
<td>5054</td>
<td>5452</td>
</tr>
<tr>
<td>Charlotte</td>
<td>9</td>
<td>1990</td>
<td>5717</td>
<td>4512</td>
<td>4191</td>
<td>3727</td>
<td>4481</td>
</tr>
</tbody>
</table>

*New stadium built in this year.
** Gwinnett and Reno do not have historic data available as the teams were created in 2009.

Given the age of stadiums for teams with ratios of marginal revenue to marginal costs below 10%, it is helpful to examine older attendance data. We have annual attendance data available for the years 1992-2010 and average per game attendance for a few select years in Table C above. (Reno and Gwinnett are ommitted because both teams were created in 2009). The descriptive statistics are consistent with declining attendance as stadiums age. While Ottawa no longer has a team, there was a large decline in attendance through the period beginning with the team playing in a new stadium. Charlotte built a new stadium before the start of the sample, but the honeymoon effect is supported by declining attendance in the 1990s. New Orleans and Syracuse both built stadiums in 1997 and saw substantial honeymoon effects. Since then, attendance has fallen significantly for New Orleans, while Syracuse averages over 5,700 fans in each of the stadium’s first five years. Although Omaha plays in an historic stadium that also plays host to the College World Series, attendance was typically around 5,700 in the late 1990s. Nashville had much higher attendance in the early 1990s, but experienced a resurgence between 2002 and 2007. Finally, Tacoma has maintained steady attendance over the available period, while attendance at Colorado Springs has grown.

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5 In 2011 Omaha played its first year in its new stadium.
Unfortunately we do not have game-by-game data for the years 1992 to 2005 in order to directly estimate marginal revenue to marginal cost ratios for the seats above 10,000. However, if attendance is distributed throughout the season in a similar manner year to year and team by team, a regression on revenue based on average yearly attendance would provide an estimate of the lost revenue for a season. We utilize attendance squared, since lost revenue is likely to be higher for high attendance teams at the margin, since they are more likely to be nearing capacity constraints. We also include a quadratic term for capacity constraints. Equation 5 below is estimated for the available game-by-game data for 2006 to 2010. Then the coefficients are applied to the yearly data going back to 1992.

5) lost revenue = $\beta_0 + \beta_1\text{average attendance}^2 + \beta_2\text{capacity} + \beta_3\text{Capacity}^2$

Results below show strong statistical significance and the three variables predict 62% of the variation in the data.

Table D: Estimated Coefficients for Attendance and Capacity

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>average per game attendance$^2$</td>
<td>0.005*</td>
</tr>
<tr>
<td>Capacity</td>
<td>98.054*</td>
</tr>
<tr>
<td>Capacity Squared</td>
<td>-0.002*</td>
</tr>
<tr>
<td>Constant</td>
<td>-881796*</td>
</tr>
</tbody>
</table>

N 136
Adjusted R-squared 62%
* significant at 1% level

Finally, Table E shows the estimated average ratio of marginal revenue to marginal cost for the teams that had MR/MC ratios below 10% for 2005-2010 and were in existence before 2005. These results are based on average per game attendance from 1992 to 2010. For teams in the table with estimated MR/MC ratios above 10%, a close look at the year-by-year data shows honeymoon effects from new stadiums, with higher attendance toward the start of the sample. This leaves us with three potential cities (Colorado Springs, Tacoma, and Omaha) where a 10,000 person stadium may be too large.

There is some evidence that the optimum stadium size might be below 10,000 for Colorado Springs, Tacoma and Omaha. Omaha averaged a ratio of 7% over the larger sample. Interestingly Omaha built a new stadium in 2011. The stadium’s capacity is just over 9,000 seats. Despite the new stadium, attendance only increased roughly 10% over 2009 and was lower than attendance in the mid 1990s. As noted, both Tacoma and Colorado Springs have stadiums below the recommended 10,000 figure. It is worth noting that both cities have populations larger than Durham, Scranton and Des Moines, which regularly have attendance justifying a 10,000 seats stadium. One possibility is that Tacoma and Colorado Springs are both within roughly a one-hour drive of their MLB affiliate, suggesting that fans may substitute minor league games with MLB baseball.

Table E: Average MR/MC from 1992-2009 using total attendance as an estimate for lost revenue
<table>
<thead>
<tr>
<th>Stadium</th>
<th>Const</th>
<th>Average MR/MC *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colorado Springs</td>
<td>1988</td>
<td>0%</td>
</tr>
<tr>
<td>Tacoma</td>
<td>1960</td>
<td>0%</td>
</tr>
<tr>
<td>Omaha</td>
<td>1948</td>
<td>7%</td>
</tr>
<tr>
<td>Charlotte</td>
<td>1990</td>
<td>13%</td>
</tr>
<tr>
<td>New Orleans</td>
<td>1997</td>
<td>14%</td>
</tr>
<tr>
<td>Nashville</td>
<td>1978</td>
<td>16%</td>
</tr>
<tr>
<td>Syracuse</td>
<td>1997</td>
<td>16%</td>
</tr>
<tr>
<td>Ottawa</td>
<td>1993</td>
<td>20%</td>
</tr>
</tbody>
</table>

* For years with predicted MR below zero, we use 0 to calculate the average.

The final two teams of interest are Gwinnett and Reno. Both teams were started in 2009 and played in new stadiums. Gwinnett in two years has sold 10,000 seats or more only seven times with all seven times coming in the team’s first year. Furthermore its lowest priced tickets of $5.00 are tied with several other teams as the cheapest in the league. It seems unlikely that Gwinnett should play in a 10,000 seat stadium. Reno is an interesting comparison, since it built a stadium with a reported capacity of 9,000 although their 2011 home opener recorded 9,490 fans. In the two years we have of game-by-game data, Reno has sold over 9,000 seats nine times in two years. Additionally the lowest priced seats in Reno are $7.00, compared to the league average of $6.25. If Gwinnett’s number of 9,000 person games is similar to Reno’s, this would suggest that Gwinnett may have been better off with a smaller stadium. Two teams have stadiums below 10,000 capacity. Colorado Springs has a stadium that has a listed capacity of 8,500. In five years it has exceeded capacity only five times and only one other game during that time has come close with over 8,400 fans. Additionally, this was after a renovation of the ballpark in 2005. Like Gwinnett, Colorado Springs also has a reported lowest ticket price of $5.00 making it tied for cheapest in AAA. In other words, Colorado Springs typically sells the last 100 seats in the park one time a year, suggesting an 8,500 person stadium may even be too large. Finally, Tacoma played in a 9,600 seat stadium from 2006 to 2010 but has failed to sell 9,100 seats in the five years of game data. In 2011 Tacoma performed a $30 million renovation on its stadium and reduced its seating capacity to 7,600, which suggests 10,000 was suboptimal.

The analysis above suggests that five of the 30 AAA teams should play in stadiums below the recommended capacity: Omaha, Colorado Springs, Gwinnett, Reno, and Tacoma. These results hold even after adjusting for new stadium construction that occurred before the game-by-game data is available for older teams. For the newer teams Gwinnett and Reno, attendance over the first two years of the team does suggest that a 10,000 seat stadium would be optimal. In the next iteration of the analysis we plan to examine the difference between teams with optimal estimated stadium size above and below 10,000.

**Conclusion**

The minimum capacity levels for minor league baseball stadiums recommended by MLB present a unique opportunity to examine optimal stadium size for sports teams. Stadiums with larger capacity have a potential to generate more ticket revenue from greater ticket sales, but also have higher...
construction and maintenance costs. Conversely, smaller stadiums that are less costly to build and maintain leave money on the table from foregone ticket sales from potentially paying fans. Using a unique data set of game-by-game data for 30 teams at the AAA level over a five year period, we are able to provide analysis that can be useful to minor league baseball executives and planners considering building or renovating stadiums in cities with these baseball teams.

Our results suggest that five baseball stadiums at the AAA level may be too large and raise the question of whether or not the MLB-recommended minimum stadium capacity is suboptimal for all levels of minor league baseball. Of course, we achieved these results by painting with very broad strokes as this is just a first pass at trying to understand this phenomenon. But the lessons learned here point to a deeper research agenda that can include examining recommended A and AA minor league baseball stadium capacities and even mandates for attendance minimums for NCAA FBS football schools. Finally, future research should include a more direct linking of the lessons learned in public utility regulation and peak-load pricing to properly modeling optimal stadium capacity.
References

*Baseball America Directory*, various years (2006-2010).


